

EDUCATION PLAN

Age range 9–13 year olds

5^B



Wow wonderfully made (2)



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Introduction to A Rocha UK

A Rocha UK is a Christian charity working for the protection and restoration of the natural world and committed to equipping Christians and churches in the UK to care for the environment. We do this through our practical involvement in community nature conservation projects, and by engaging with churches, schools, land owners, communities and individuals – educating, equipping and inspiring them to participate in caring for the earth and its resources. Our vision is for Christians and Churches of all denominations to care for creation as an integral part of loving their neighbours and following God faithfully.

Introduction to Wow wonderfully made

Title	Education Plan 5b. Wow wonderfully made - Insects.
Subject	Science and RE (supporting material and ideas at end to supplement).
Overview & age	Life cycles of insects. Suggested age range 9 - 13 year olds.
Time	3 hours, full morning or afternoon.
Location(s)	A mixture of in and outdoor activities including pond dipping.
Learning Objectives	<ul style="list-style-type: none"> ● To understand the different stages in the life cycles of an insect. ● Observe & compare the life cycles of insects in their local/global environment. ● To experience a sense of awe and wonder at nature's complete and incomplete metamorphosis' stages.
Resources in order of usage	<ul style="list-style-type: none"> ● Document Resource 1: Insect life cycles ● Document Resource 2: Stages of butterfly life cycle ● Hungry caterpillar, pupa, leaf & egg and butterfly pupa toy. ● Document Resource 3: Dragonfly or Damselfly game ● Document Resource 4: Dragonflies and Damselflies fact sheet ● Document Resource 5: Pond species worksheet ● Bucket, pond dipping nets, plastic spoons, magnifying glasses, trays, clipboards, pencils. ● Document Resource 6: Bible passage
Preparation / space required	<p>Preparation: Do a scope for litter and overgrowth at the pond. If possible, pond dip earlier in the day (or previous day) to see if any dragonfly larvae (plural of larva) can be found to show children. (Keep them in water and away from the pond for as short a time as possible.)</p> <p>Start indoors or outdoors but would be good to have the ability to watch a 5 minute video of dragonfly larvae at Foxearth Meadows (see ^).</p> <p>Transfer to a pond dipping facility with a flat area for most of the children to be far enough away from water. Ideally with scope to find.</p> <p>Come back inside or stay in the field at the end, for listening, singing, drawing, Biblical discussion and more, if possible with the ability to sing along to a video (see *).</p>
Disclaimer	<p>These resources are a set of free environmental education materials, provided by A Rocha UK to schools, colleges and youth groups. They may be printed for event use, but please acknowledge A Rocha UK and the authors of the material (where supplied).</p> <p>It is the responsibility of the individual or institution using the education plans to ensure that a full Risk Assessment has been carried out and that adequate insurance provision has been given for the activities.</p> <p>It is also the responsibility of that same individual or institution to ensure the activity is age appropriate and suitably supervised by qualified individuals.</p> <p>A Rocha UK takes no responsibility for any loss, damage, injury, death or litigation related in whole or in part to any event or activity related to the plan.</p>

Education Plan Activities

Time	Leader	Children
<p>0. & 1a. Total time 15 mins</p> <p>15 mins</p>	<p>0. Background – Setting the scene Welcome and thank you to A Rocha UK for providing the education plan (please see our Contents Page for an overview of our charity’s work, which we would be delighted for you to share about here).</p> <p>1. Insects 1a. Starter <i>(Resources: 1 Insect life cycles)</i> What do you know about insects? Name some.</p> <p>Brief introduction to insects and their life cycles from the resource <i>(you decide the amount of detail)</i>.</p> <p>1b. Butterfly Life Cycle <i>NC 5/L/a, NC 5/L/b.</i> <i>(Resources: Hungry caterpillar pupa toy, 2 Stages of butterfly life cycle)</i> Ask 4 volunteers to hold each part of the toy and 5 volunteers to hold Stages of butterfly life cycle labels. Ask volunteers to organise themselves in what they think is the right order for the life cycle of a butterfly. Using the resources, decide which stage belongs with each part of the toy.</p> <p>Protecting species may mean protecting several different environments, e.g. Butterflies need:</p> <ol style="list-style-type: none"> 1. A food source for caterpillars 2. Safe places for chrysalis 3. Food sources and suitable weather for adult butterflies. <p>Not all insects have the same life cycle stages. For example, butterflies and dragonflies are different in the number of stages they have.</p>	<p>Listen and look at the logo.</p> <p>Q & A</p> <p>Listen & look at pictures.</p> <p>Watch and help 9 volunteers put the toys and stages in sequence.</p> <p>Listen and Q & A for suggestions on protecting these environments.</p> <p>Listen</p>
<p>2. Total time 30 mins</p>	<p>2. Dragonflies and damselflies 2a. Game <i>(Resources: 3 Dragonfly or Damselfly game)</i> Protecting species and understanding life cycles helps us understand how important it is to look after the different habitats these creatures need for their different life cycles, e.g. Dragonflies and Damselflies need:</p> <ol style="list-style-type: none"> 1. An environment for egg-laying (differing by species, from lily pads to tree branches, from still water to slow running rivers) 2. An underwater habitat for larvae 3. Something for the larvae to climb up so that the adult can emerge. 4. Food & suitable weather for adult dragonflies 	<p>Listen</p>

<p>5 mins</p>	<p>Ask children to describe dragonflies and damselflies.</p> <p>Using the resource, give some information on the physical attributes of dragonflies and damselflies.</p> <p>Then play the game - <i>for the children to remember the differences.</i></p> <p>2b. Lifecycles <i>(Resources: 4 Dragonflies and Damselflies fact sheet, video^)</i> Using the resource, give more information, particularly on the lifecycle of dragonflies and damselflies.</p> <p>If possible watch the video^, of dragonfly larvae at A Rocha UK's Nature Reserve called Foxearth Meadows: https://drive.google.com/open?id=1FeQAmM-e50GEIZWp9zHlaqGALuSWX_7O</p>	<p>Q & A</p> <p>Listen & look at pictures.</p> <p>Do the actions for the game.</p> <p>Listen</p> <p>Watch video</p>
<p>3. Total time 45 mins</p>	<p>3. Outdoor activity - Pond dipping <i>(Resources: 5 Pond species worksheet, pond dipping nets, plastic spoons, magnifying glasses, trays, pencils)</i> Animals are living things, so we need to treat them with care. These animals live in water, so we need to keep them in the tray, so they do not drop on the ground. <i>While talking, put water from a bucket into a tray for each group.</i></p>	<p>Go outside near the pond, flat area, far enough away from water. Listen.</p>
<p>5 mins</p>	<p>Explain that many of the insects we find in the pond are larvae (young insects), do you remember what these look like? Today we will look for dragonfly and damselfly larvae. Ask for the description of the stages of the dragonfly life cycle (egg, larvae, adult).</p>	<p>Listen and Q & A.</p>
<p>20 mins</p>	<p>Ask if they have done pond dipping before. Split into groups of 3 or 4. 1 person in each group is responsible for the tray and keeping species safe, another 1 to inspect the tray with a spoon and magnifying glass, third to have the pond species worksheet to fill in, last person uses the net and is the only one to go near the pond. They will carry findings back, to put into the tray.</p> <p>Pond dip. Have a few minutes each, then swap around, so everyone can have a turn using the net. Fill in the pond species worksheet.</p>	<p>Listen to instructions, get into groups of 3 or 4 and collect equipment.</p> <p>Pond dip in groups and try to identify findings.</p>
<p>10 mins</p>	<p>Look at the findings across groups. If no dragonfly larvae are found, use any caught while doing the scope / preparation. At the end, put water and species back in the pond.</p>	<p>Share findings.</p>
<p>5 mins</p>	<p>Summary: Can you remember the different life cycle stages of butterflies & dragonflies?</p>	<p>Shout out answers.</p>

<p>4. Total time 30 mins 10 mins</p> <p>20 mins</p>	<p>As we said in the introduction dragonflies can have many stages of moulting. Compare this to the life cycle of butterflies which have caterpillars and less stages of moulting.</p> <p>4. Habitats (inside or outside) 4a. Introduction Give an introduction to habitats, what are they and where would you find them? <i>A habitat is a place where animals and plants live and are best suited. (EP 6 goes more in depth on habitats.)</i></p> <p>Today we have seen that the pond is a wetland habitat: What do you think insects / plants / animals gain from habitats? <i>Insects and animals are best suited to thrive in their own habitat, as it offers them food, shelter, and the right conditions to have young.</i></p> <p>4b. Habitats for butterflies and dragonflies <i>(Resources: Hungry caterpillar pupa toy, 2 Stages of butterfly life cycle)</i> Try to remember the life cycle of a butterfly again - use / have out the caterpillar toy and butterfly life cycle resources.</p> <p>What do you think the best habitats are for butterflies and dragonflies to lay their eggs? Are they the same? <i>Butterflies prefer to lay their eggs on the best leaves for the caterpillars to eat when they hatch. Therefore the grassland habitat is best for butterflies as they prefer dry conditions to lay their eggs. They don't lay their eggs in underwater plants or into water.</i> <i>Dragonflies and damselflies breed in wetlands. They need water to breed.</i> <i>Note: when it comes to habitats for individual species thriving, there are always exceptions - the wonder of nature!</i></p>	<p>Listen</p> <p>Listen and Q & A's</p> <p>Watch and help volunteers put the toys and stages in sequence. Listen and Q & A.</p>
<p>5. Total time 30 mins 5 mins</p> <p>10 mins</p>	<p>5. Wonderfully made (inside or outside) 5a. Connection to Bible <i>(Resources: 6 Bible passage)</i> Read Psalm 139:13-16 from resource.</p> <p>What do these verses say about what God sees and knows? What do they say about Him and us?</p> <p>5b. Making me me <i>(Resources: song video*)</i> God made you exactly as he intended, completely unique and completely loved as his child. This song of thanksgiving reminds us to thank our creator for making us as we are. It does this by asking us to think about ourselves and animals, using our bodies to celebrate.</p>	<p>Listen</p> <p>Listen and get involved in Q & A's</p> <p>Listen</p>

<p>10 mins</p> <p>5 mins</p>	<p>If possible, sing song together 'If I were a butterfly', from video* below, lyrics are on it https://www.youtube.com/watch?v=L-nb5CR1uec Could sing a few times, adding actions, get a few volunteers up to the front who know it.</p> <p>5c. Drawing <i>(Resources: paper, colouring pencils)</i> Draw the life cycle of a dragonfly or damselfly, butterfly or bee.</p> <p>5d. Plenary Why do we have to change? Why do we have life cycles? Any other reason other than survival?</p>	<p>Watch or sing the song. Could do it a few times with actions.</p> <p>Draw</p> <p>Think and discuss</p>
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Copyright Information

^ Dragonfly larvae video from 'Countryfile', a BBC production showing A Rocha UK's rural nature reserve called Foxearth Meadows, the UK's only nature reserve managed primarily for dragonflies and damselflies:

https://drive.google.com/open?id=1FeQAmM-e50GEIZWp9zHlagGALuSWX_70

Start at 13 min 5 seconds, see fluffy willow down on the breeze, then the presenter Ellie Harrison is walking through it. Lasts for 5 mins and 55 seconds - end at 19 minutes.

Insect Life cycles: <https://www.youtube.com/user/watchfreeschool>

<https://www.youtube.com/watch?v=rKQfJFAHW8Q>

<https://www.amentsoc.org/insects/fact-files/life-cycles.html>

<https://aggie-horticulture.tamu.edu/>

Insect Life cycles - Incomplete and Complete metamorphosis:

Photos 2006 by MGs Herman Auer, Laura Bellmore, Patsy Jewell and Deborah Repasz.

Graphics 2006 by Linda Steber. <https://aggie-horticulture.tamu.edu/galveston>

Dragonflies and Damselflies information, game and Four-spotted Chaser photo David Chandler

Hawker Dragonfly larva photo by Jan Hamrsky www.lifeinfreshwater.net

Common Blue Damselfly photo by Norman Crowson

* 'If I were a butterfly' song video <https://www.youtube.com/watch?v=L-nb5CR1uec>

Video from Unreached Corners. The Butterfly Song - Brian Howe

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Music produced and mixed by Nic Rowley at Vandborg Studios. Backing tracks arranged, performed and recorded by Nic Rowley, Jane Carr, James Welch and Katie Chatburn. Recording engineer James Welch at Masterlink Productions.

This is an acknowledgment of the resources we have used. Please be aware of the Authors' Licensing and Collecting Society, which collects payments on behalf of an author when his or her books are photocopied.

Document Resources Inventory - print all once unless specified otherwise

0. A Rocha UK introduction
1. Insect life cycles – information
2. Stages of butterfly life cycle – labels and arrows *print arrow (on page 10) 3 times*
3. Dragonfly or Damselfly game – information and photos
4. Dragonflies and Damselflies fact sheet – information and photos
5. Pond species worksheet *print 5 - 8 copies, one per pond dipping group of 3*
6. Bible passage

Document Resource 1: Insect life cycles

Insects are the largest group of animals on earth; nearly 1 million species have been identified. They live on and in the ground, water and air, all over the world, even Antarctica. Insects are vital to the ecosystem as they help in plant pollination and the decomposition of plants and animal parts. Insects can be helpful predators and are themselves a food source for many organisms and people. They are invertebrates (animals without a backbone) but have a hard outer shell called an exoskeleton. They have three main sections of body: Head, Thorax & Abdomen, with 6 legs connected to the thorax.

Life cycles: There are two different types of insect life cycle - *incomplete & complete metamorphosis*

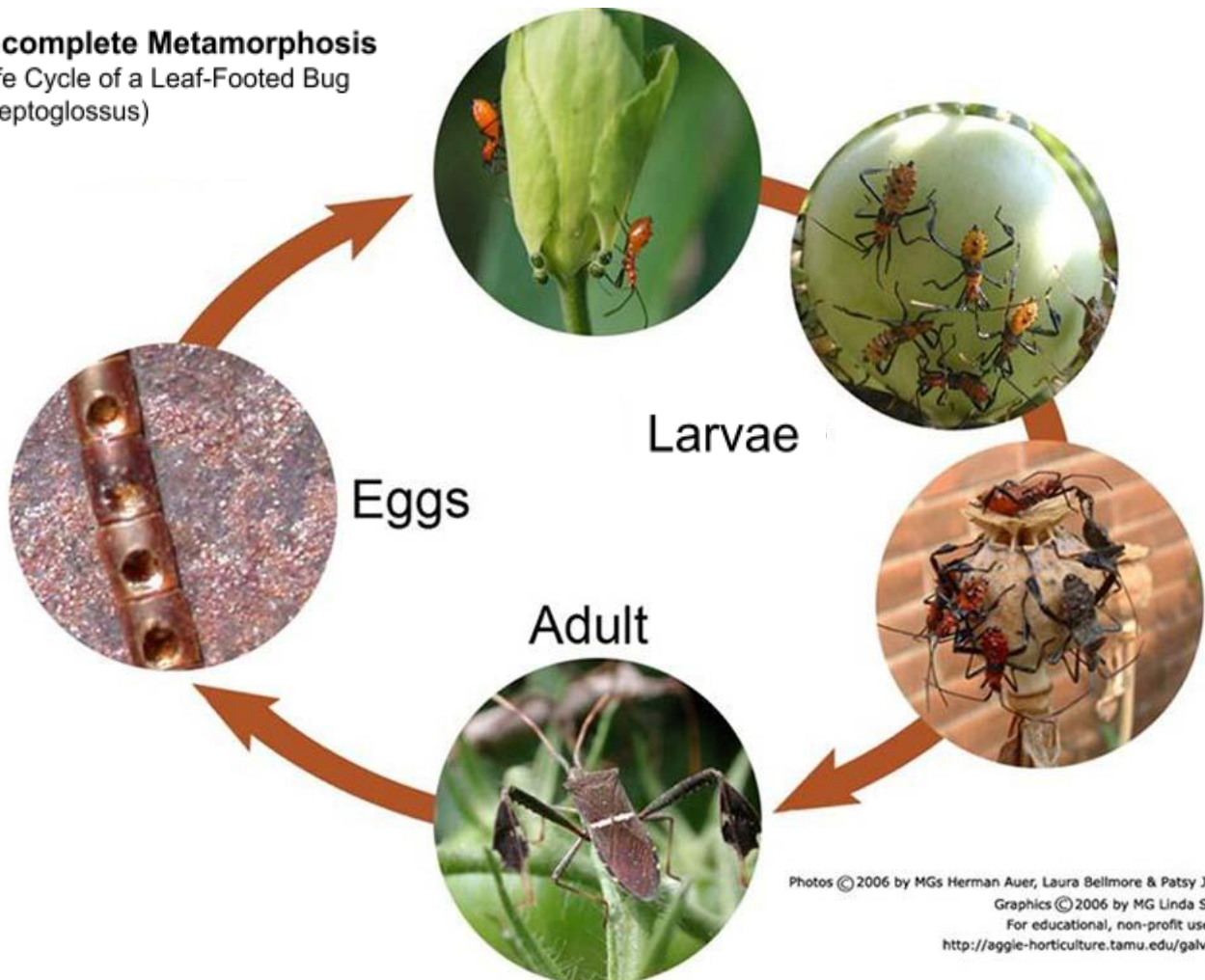
Incomplete Metamorphosis (metamorphosis means a change of form)

This life cycle shows only three stages: *EGG - LARVA - ADULT*, shown by less highly developed insects. The larva resembles a miniature adult but is not able to produce young. This type of life cycle is seen in various insects including dragonflies, grasshoppers, earwigs, and cockroaches.

Disadvantage: larvae (plural of larva) & adults often share the same food source, so can be in direct competition for food.

Advantage: the vulnerable pupal ([chrysalis](#)) phase is avoided. The wings develop during the larval stages as wing buds outside the body. They are fully formed at the final moult into adulthood.

Incomplete Metamorphosis Life Cycle of a Leaf-Footed Bug (Leptoglossus)



Complete Metamorphosis

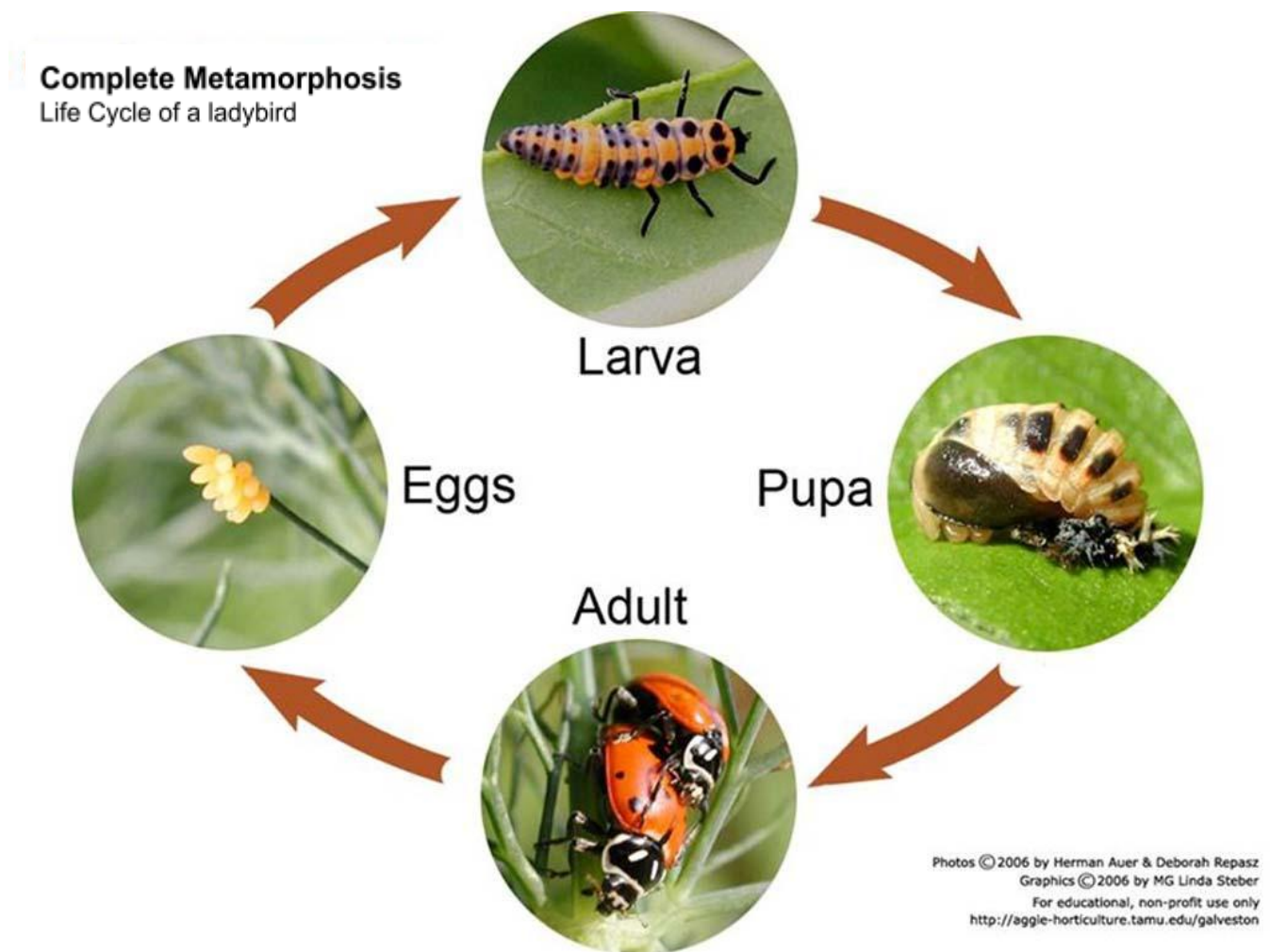
The life cycle shows four stages: *EGG* - *LARVA* - *PUPA* - *ADULT*, shown by more highly developed insects.

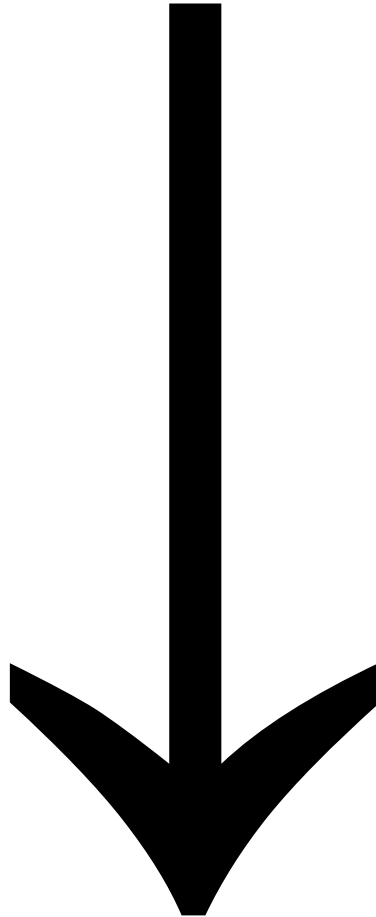
The larva (or caterpillar for moths and butterflies) is the growth phase; usually very different from the adult. Such a life cycle is shown by many insects: butterflies, moths, bees, wasps, true flies and beetles.

Advantage: Generally the larva and adult use different food sources, therefore they are not in direct competition for food.

Disadvantage: the pupa (or chrysalis) is vulnerable - a stage of internal reorganisation.

There are no visible signs on the outside of the body as to the activity within, therefore the pupal phase used to be called the 'resting' stage. During the pupal phase the internal organs are broken down, more or less forming a "soup", which acts as food for special growth buds to develop. These form the adult body and the wings develop inside the pupal case. When the internal reorganisation is complete and outside conditions are suitable, the final moult occurs and the adult insect emerges.





Egg

Caterpillar (larva)

Pupa

Butterfly (Adult)

Document Resource 3: Dragonfly or Damselfly game

A simple activity to help learn the differences between a true dragonfly and a damselfly. Introduce the differences – using the photos below to illustrate:

EYES: There's a gap between a damselfly's eyes. On a true dragonfly the eyes touch each other. *(There's one exception in this country – the Common Clubtail (which isn't common!)).*

Action: place fists (as eyes) in front of your eyes – touching (dragonfly), or obviously apart (damselfly)

BODY: Damselflies have long, thin bodies like flying matchsticks. True dragonflies are chunkier.

Action: stand long and thin with arms at your sides (damselfly) or with arms bent and hands on hips to look chunky (dragonfly).

WINGS: Damselflies rest with their wings along their 'back'.

(There are a few exceptions – emerald damselflies settle with wings sticking out at 30-45°).

When they settle, true dragonflies' wings stick out from their body at right angles.

Action: arms held along back (damselfly) or arms sticking out (dragonfly).

FLYING: Damselflies are weak, fluttery fliers. True dragonflies are strong fliers.

Action: act it out, slow, with hands as little flappy wings (damselfly) or strong with arms out (dragonfly).

	Eyes	Body (strictly, abdomen)	Wings (when still)	Flying
Damselfly	Eyes are separate, each side of head	Matchstick thin	Usually brought together over back	Weak, fluttery fliers
Action	Put fists either side of head	Stand tall & thin, arms straight down by body	Arms straight down, and hands behind back	Slow, fluttering hands as flappy wings



	Eyes	Body (strictly, abdomen)	Wings (when still)	Flying
Dragonfly	The eyes touch each other	More chunky	Stick straight out	Strong fliers
Action	Fists touching in front of face	Stand with arms bent, & hands on hips for wide body	Arms out	Run around, arms out, flapping strongly



The game, leader says: **Dragonfly or Damselfly** then **eyes, body, wings or flying**

Children have to do the action. Call out slowly at first, in order. Then call in random order & speed up.

Document Resource 4: Dragonflies and Damselflies fact sheet

What do dragonflies and damselflies look like?

- A dragonfly's hind wings are usually shorter and broader than their forewings. When a dragonfly is resting, it holds its wings straight out from its body like an aeroplane.
- All four of a damselfly's wings are equal in size and shape. Most British damselflies hold their wings over their back.
- Most British dragonflies have eyes that touch each other, if only at a single point. Damselflies' eyes are always separated. A single dragonfly eye can have up to 28,672 ommatidia (facets).
- Both have minute antennae and specialised mouthparts.
- Dragonflies are larger, have a more powerful build and are generally stronger fliers than damselflies.



There are 3 stages of dragonfly (here refers to 'true dragonflies' & 'damselflies') life cycle: egg, larva & adult:



Dragonflies are predators and spend most of their lives as larvae; aquatic, wingless. Usually mottled or dull in colour, matching the sediments or water plants where they live. They catch & eat live prey at every opportunity. As it grows it moults 7–17 times until it is fully-grown. Next if the weather is right the larva will metamorphose into an adult, by crawling out of the water up the stem of a plant (often at night), moulting one last time, emerging as an adult, and leaving behind a cast skin (exuvia).

Fun fact: True dragonfly-like insects were around 325 million years ago. One had a 70-75cm wingspan!

Favoured habitats and food?

- Favourite habitats: still or slow-moving bodies of water. Usually found in and around lakes, ponds, streams, rivers, bogs and other wetlands.
- Although some do breed in faster flowing waters.
- Can also be found flying well away from water.
- Larval food includes fly larvae, crustaceans, tadpoles, small fish. Adult food: small flying insects.



How to help conserve dragonflies and damselflies?

- The most important thing is to create a pond in your garden. Shallow ponds, sheltered from wind, although not from sun, are the most suitable and if possible clean, unpolluted, & non-acidic pH.
- Add a mix of vegetation in and around the water including submerged plants (for oxygen and larvae to lurk in), emergent plants – for larvae to climb up when it is time, and floating plants (some species settle on them, or lay eggs in them). Some rotting wood (old branch) in the water is good too. Although make sure about $\frac{2}{3}$ of the pond is open water. Dragons and damsels head away from the water when they first emerge to feed and mature. More info from [The British Dragonfly Society](http://www.britishtdragonfliesociety.org).

Document Resource 5: Pond species worksheet






Habitat: Pond Date:

Temperature:

Weather Cloud cover:

Name:

Wind Speed:

Photograph	Name	Tick box	Total
	Freshwater snail		
	Water hoglouse		
	Tadpole		
	Water scorpion		
	Dragonfly larva		

Free space for other species

Psalm chapter 139 verses 13 - 16 (New International Version)

¹³ For you created my inmost being; you knit me together in my mother's womb.

¹⁴ I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well.

¹⁵ My frame was not hidden from you when I was made in the secret place, when I was woven together in the depths of the earth.

¹⁶ Your eyes saw my unformed body; all the days ordained for me were written in your book before one of them came to be.

Additional Resources

Resources you may need to purchase (prices may be subject to change)

Resource	Price	Source	Web address
Very Hungry Caterpillar Life Cycle Stages	£9.00	The Royal Horticultural Society	https://shop.rhs.org.uk/gifts/children/indoor-games-toys/very-hungry-caterpillar-life-cycle-toy
Scrunch pond dipping net	£6.48 each (X4 = £25.92)	Muddy Faces	https://muddyfaces.co.uk/shop/products/scrunch-net Also used in EP 6
White Pond Dipping Sample Trays	£2.51 each (X4 = £10.04)	Muddy Faces	https://muddyfaces.co.uk/shop/products/white-tray Also used in EP 6

Total cost: £44.96

Other resources inventory

1. Plastic spoons (5 - 8, one per pond dipping group)
2. Magnifying glasses (5 - 8, one per pond dipping group)
3. Clipboards (5 - 8, one per pond dipping group)
4. Pencils (5 - 8, one per pond dipping group)
5. A4 plain paper
6. Colouring pencils

Extra links

For more information on [Garden and Habitat Management](#) particularly around ponds and managing them for dragonflies, see this link from The British Dragonfly Society.